

What is claimed:

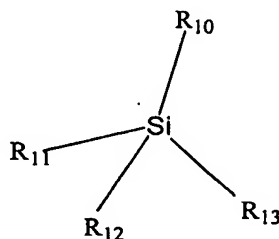
1. Gas layer formation material selected from the group consisting of acenaphthylene homopolymers; acenaphthylene copolymers; norbornene and acenaphthylene copolymer; polynorbornene derivatives; blend of polynorbornene and polyacenaphthylene; poly(arylene ether); polyamide; B-staged multifunctional acrylate/methacrylate; crosslinked styrene divinyl benzene polymers; and copolymers of styrene and divinyl benzene with maleimide or bis-maleimides.

2. The gas layer formation material of claim 1 having less than two percent weight loss after holding at 300°C for one hour.

3. The gas layer formation material of claim 2 wherein said material is selected from the group consisting of acenaphthylene homopolymers and acenaphthylene copolymers.

4. The gas layer formation material of claim 1 additionally comprising an adhesion promoter.

5. The gas layer formation material of claim 1 additionally comprising silane of the following formula



where R<sub>10</sub>, R<sub>11</sub>, R<sub>12</sub>, and R<sub>13</sub> is the same or different and selected from the group consisting of hydrogen, alkyl, aryl, alkoxy, aryloxy, acetoxy, chlorine, or combinations thereof, and where at least one of R<sub>10</sub>, R<sub>11</sub>, R<sub>12</sub>,

and R<sub>13</sub> is alkoxy, aryloxy, acetoxy, or chlorine; organosiloxane; phenylsiloxane polymer; methylphenylsiloxane polymer; siloxane polymer; hydrogen silsesquioxane; or methyl silsesquioxane.

5           6. A spin-on depositable material comprising said gas layer formation material of claim 1.

          7. A chemical vapor deposition precursor comprising said gas layer formation material of claim 1.

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          8. A film comprising said gas layer formation material of claim 1.

          9. A substrate having said film of claim 8 thereon.

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15           10. A method of forming a gas layer comprising the step of: using a gas layer formation material selected from the group consisting of acenaphthylene homopolymers; acenaphthylene copolymers; norbornene and acenaphthylene copolymer; polynorbornene derivatives; blend of polynorbornene and polyacenaphthylene; poly(arylene ether); polyamide;  
20   B-staged multifunctional acrylate/methacrylate; crosslinked styrene divinyl benzene polymers; and copolymers of styrene and divinyl benzene with maleimide or bis-maleimides.

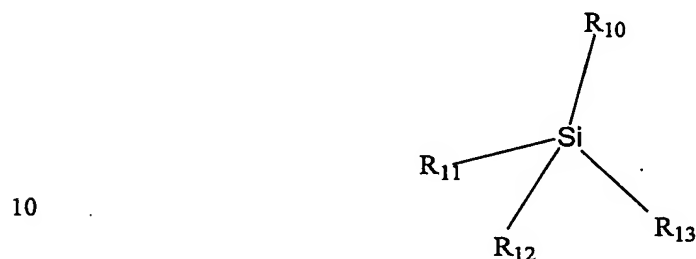
          11. The method of claim 10 wherein said material has less than  
25   two percent weight loss after holding at 300°C for one hour.

          12. The method of claim 10 wherein said material is selected from the group consisting of acenaphthylene homopolymers and acenaphthylene copolymers.

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13. The method of claim 10 wherein said material additionally comprises adhesion promoter.

14. The method of claim 10 wherein said material additionally  
5 comprises silane of the following formula



where R<sub>10</sub>, R<sub>11</sub>, R<sub>12</sub>, and R<sub>13</sub> is the same or different and selected from the group consisting of hydrogen, alkyl, aryl, alkoxy, aryloxy, acetoxy, chlorine, or combinations thereof, and where at least one of R<sub>10</sub>, R<sub>11</sub>, R<sub>12</sub>,  
15 and R<sub>13</sub> is alkoxy, aryloxy, acetoxy, or chlorine; organosiloxane; phenylsiloxane polymer; methylphenylsiloxane polymer; siloxane polymer; hydrogen silsesquioxane; or methyl silsesquioxane.

15. A process comprising the steps of:

20 (a) in an inter-level dielectric layer, incorporating a polymer having:  
(i) a glass transition temperature of greater than about 200°C, (ii) less than two percent weight loss after holding at 300°C for one hour, and (iii) a decomposition temperature of greater than about 350°C;

(b) heating said polymer to a temperature of greater than about  
25 350°C; and

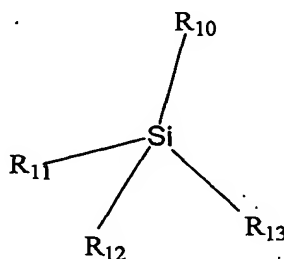
(c) removing the heated polymer.

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16. The process of claim 15 wherein said polymer is selected from the group consisting of acenaphthylene homopolymers and  
30 acenaphthylene copolymers.

17. The process of claim 15 wherein said polymer additionally comprises adhesion promoter.

18. The process of claim 15 wherein said polymer additionally  
5 comprises silane of the following formula



where  $R_{10}$ ,  $R_{11}$ ,  $R_{12}$ , and  $R_{13}$  is the same or different and selected from the group consisting of hydrogen, alkyl, aryl, alkoxy, aryloxy, acetoxy, chlorine, or combinations thereof, and where at least one of  $R_{10}$ ,  $R_{11}$ ,  $R_{12}$ ,  
15 and  $R_{13}$  is alkoxy, aryloxy, acetoxy, or chlorine; organosiloxane; phenylsiloxane polymer; methylphenylsiloxane polymer; siloxane polymer; hydrogen silsesquioxane; or methyl silsesquioxane.

19. The process of claim 15 additionally comprising prior to said  
20 step (b), treating said polymeric layer by exposure to electron beam radiation, ion beam radiation, microwave radiation, ultraviolet radiation, infrared radiation, or x-ray.

20. A microchip comprising a gas layer wherein the gas layer is  
25 formed by:

(a) forming a layer of polymer having: (i) a glass transition temperature of greater than about 200°C, (ii) less than two percent weight loss after holding at 300°C for one hour, and (iii) a decomposition temperature of greater than about 350°C;

30 (b) decomposing the polymeric layer; and

(c) volatilizing the decomposed polymeric layer wherein the gas layer forms.

21. The microchip of claim 20 wherein said polymer layer is formed on a substrate.

5 22. A microelectronic device comprising:

(a) substrate;

(b) a layer of thermally degradable polymer having a glass transition temperature of at least 200°C and is capable of being degraded and volatilized;

10 (a) porous capping layer adjacent to said polymeric layer;  
and

(d) metal barrier layer adjacent to the ends of said polymeric layer.

23. The microelectronic device of claim 22 wherein said thermally  
15 degradable polymer is selected from the group consisting of acenaphthylene homopolymers; acenaphthylene copolymers; norbornene and acenaphthylene copolymer; polynorbornene derivatives; blend of polynorbornene and polyacenaphthylene; poly(arylene ether); polyamide; B-staged multifunctional acrylate/methacrylate; crosslinked styrene divinyl  
20 benzene polymers; and copolymers of styrene and divinyl benzene with maleimide or bis-maleimides.

24. A process for forming a microelectronic device comprising the steps of:

25 (a) applying thermally degradable polymer having a glass transition temperature of at least 200°C on a substrate;

(b) applying a porous capping layer on said thermally degradable polymer layer;

(c) patterning said thermally degradable polymer and porous  
30 capping layers;

(d) applying metal barrier layer to said patterned layer;

- (e) thermally degrading said polymer; and
- (f) volatilizing said degraded polymer to form a gas layer.

25. The process of claim 24 wherein said thermally degradable  
5 polymer is selected from the group consisting of acenaphthylene  
homopolymers; acenaphthylene copolymers; norbornene and  
acenaphthylene copolymer; polynorbornene derivatives; blend of  
polynorbornene and polyacenaphthylene; poly(arylene ether); polyamide;  
B-staged multifunctional acrylate/methacrylate; crosslinked styrene divinyl  
10 benzene polymers; and copolymers of styrene and divinyl benzene with  
maleimide or bis-maleimides.

26. The process of claim 24 additionally comprising prior to said  
step (e), treating said thermally degradable polymer by exposure to  
15 electron beam radiation, ion beam radiation, microwave radiation,  
ultraviolet radiation, infrared radiation, or x-ray.